THE FIRST COMPREHENSIVE BIRD SURVEY OF HATU-ITI ISLAND, MARQUESAS ISLANDS, FRENCH POLYNESIA

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SUMMARY

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We surveyed wildlife species on Hatu-iti, a small, remote island in the northern Marquesas Islands of French Polynesia. Our visits during 2009 and 2010 were the first by a group of avian researchers since the 1922 Whitney South Seas Expedition. We recorded 23 species of birds, including 16 breeding species, and several insect and lizard species. Our study identified for the first time breeding of Phoenix Petrel at this site, along with an important population of Red-tailed Tropicbirds. Tropical seabirds typical of the region were found in large numbers. Some species, such as the Polynesian Storm-Petrel and Sooty Tern, were restricted to a small, low-lying stack. Pacific Rats at the main island may be inhibiting breeding of these species on the 24 ha site.

Keywords: Hatu-iti, seabirds, survey, French Polynesia

INTRODUCTION

Remote offshore sites are havens for biodiversity, and the Pacific Ocean has myriad small sites that harbour many threatened species. The more than 25 000 islands in the region are home to one-quarter of the critically endangered species of bird in the world (Steadman 2006, BirdLife International 2010). Many sites have invasive species or have suffered from habitat degradation over millennia of use by humans. However, there are a few sites with relatively intact fauna and with potential for habitat restoration.

We visited a remote site, Hatu-iti, in the Marquesas Islands, French Polynesia, during one day in September 2009 and five days in March 2010. The site had previously been visited by Rollo H. Beck and W.B. Jones on 19 September 1922 as part of the Whitney South Seas Expeditions (WSSE). Beck (unpublished journal) spent a few hours one afternoon on the lower slopes of the site, noting "I did not go to the top, being too busy and the pathway being dangerous if possible." Jones collected plant specimens. Subsequently, the site was visited by botanists prospecting for plant specimens on 5 July 1988 (S. Perlman, J. Florance, F. Teikiteetini, pers. comm.).

Our study aimed to assess the biodiversity values and potential for site restoration of the uninhabited Hatu-iti islet and its associated stack. We surveyed birds and mammals at the site, and assessed its potential for eradication of Pacific Rats *Rattus exulans*. The 2009 and 2010 surveys represented the first detailed surveys of the avifauna of the site, and we timed the trips to maximise opportunities of finding nesting bird species.

STUDY AREA AND METHODS

Hatu-iti (8.675°S, 140.616°W), also known as Motu iti, is a rocky volcanic island 43 km northwest of Nuku Hiva (Fig. 1). It is composed of two islets (one larger, one very small) and two rocks at sea-level. The main islet is around 24 ha in size and rises approximately 232 m above sea level. It has cliffs on all sides, some of which have accessible, tussock-covered ledges. The second islet is a rock stack (hereafter, the stack) to the southeast of the main islet, <3 ha in size and 76 m in elevation. It was also surveyed. The geological age of Hatu-iti is unknown, and we collected rocks in 2009 and 2010 to address this information gap.

On 25 September 2009, one of us (J.F.B.) spent a few hours on Hatu-iti searching for bird and plant species. In 2010, our party of four spent four nights on Hatu-iti 21–25 March 2010, and conducted ground searches for seabird nests. We undertook transect surveys for petrel burrow density by day and searched at night by listening and spotlighting. Two one-hour searches of the stack were undertaken during daylight on 25 September 2009 and 25 March 2010.

In 2010, transect surveys were carried out by pairs of observers using handheld GPS to indicate the length of each transect. Twenty-eight transects were completed, with most transects being 100 m in length. Observers walked on a given bearing and searched for burrows within a 1 m strip each side of the survey line, under rocks and vegetation. Each observer counted the burrows independently. As there were few differences between observers in the results, we used an average result for each transect to estimate burrow density. Small

and large burrows were counted separately, and used to indicate Audubon's *Puffinus lherminieri* and Wedge-tailed Shearwater *P. pacificus* population sizes, respectively. Size cut-off between small and large burrows was approximately 7 cm diameter. At sites we had visited in the Marquesas Islands previously, burrows smaller than this size were occupied exclusively by Audubon's Shearwater. Only areas on the plateau of the islet were surveyed with transects, other areas being considered unsafe for prolonged visits.

The vegetation on the upper slopes of Hatu-iti was fairly uniform, with a dense sward of tussock *Leptochloa xerophila*, so we applied a homogenous burrow density estimate to calculate the total number of burrows for each of the shearwater species. We hand-searched nine small and 54 large burrows but found no occupants during our visit, with a maximum of seven burrows counted in any 100 m transect. We therefore used literature-based burrow occupancy of 47% occupancy with 95% confidence interval to calculate a population size for each of the petrel species present (see review in Waugh *et al*. 2003). This rate was the average of rates observed for other shearwater populations at sites without large mammalian predators.

Walk-through surveys were conducted for all species other than petrels, with two independent counts undertaken by observers for each species in 2010. Estimates from one observer (J.F.B.) are described for 2009. All counts were done as "ground-counts," with breeding sites being visited on foot or counted from vantage points with binoculars. Sooty and Grey-backed Tern numbers were estimated from flocks in flight, when visiting the nesting/roost sites, and were estimated by counting groups of 10 to 100 birds, and extrapolating to a whole site population based on the area of sky occupied. Red-tailed Tropicbird nests were searched and their location ascertained by GPS in 2010 to avoid double-counting particular nests. We observed cliff areas vigilantly each evening to look for small species, e.g. storm-petrels and swiftlets, returning to their crevices at dusk.

We set out traplines for rats nightly, and inspected these each morning. Sixty traps were set nightly, for a total of 171 trap-nights. Necropsy was performed on any rats caught to identify their species, sex and maturity.

RESULTS

Avifauna

A summary of the bird observations and collections from the 1922 Whitney South Seas Expedition (Beck unpublished journal, Stickney 1943), and our observations from 2009 and 2010 follows. Species are listed in taxonomic order.

Fig. 1. Hatu-iti seen from the east. Photo Jean-François Butaud.

Phoenix Petrel *Pterodroma alba*. Breeder. One pair was seen flying over the islet on 19 September 1922 (Beck unpublished journal); the male (in nonbreeding condition) was collected (American Museum of Natural History, AMNH). This species was not seen in September 2009. Two birds were seen flying over the island, and one occupied burrow (200 m elevation) was found, in March 2010. The burrow contained one bird and an egg. The birds were visible from 15h30 until sunset. They flew repeatedly around the valleys on the upper areas of the islet for up to 30 min at a time. One was observed to land and call near to its burrow. The bird was measured: wing length 300 mm, culmen length 29.5 mm, tarsus 36.5 mm.

Bulwer's Petrel *Bulweria bulwerii*. Probable breeder. Several were seen at sea around the islet in September 2009 and March 2010.

Wedge-tailed Shearwater *Puffinus pacificus*. Breeder. Three pairs were found in their burrows under "tussock grass and in a cave" (during pre-laying period) on 19 September 1922 (Beck unpublished journal); three males and two females were collected (AMNH). This species was not seen in September 2009. During March 2010, they were heard each evening from 18h30, and in the mornings between 03h45 and 05h30. They nested in tussocks and in cavities in cliff areas, between 70 m and 200 m altitude. They were not seen on the stack. We estimated 1000–1600 breeding pairs in the tussock areas. This is likely to underestimate the total population size, however, as it did not take into account birds nesting in cliff areas. None of the burrows examined by hand was occupied during the day, although we encountered adult birds in burrows during the day, but no eggs or chicks. The calls of this species were very prominent at night throughout the higher altitude parts of the island.

Audubon's Shearwater *Puffinus lherminieri*. Breeder. Numerous individuals were heard and seen in flight during similar hours as the Wedge-tailed Shearwater, in March 2010. Adults only were seen. Again, estimates of 440–890 pairs for tussock areas are likely to be underestimates of the whole population as many birds nested in cliff areas (not sampled with transects). At least two adults, one juvenile and burrows were seen on the stack, in among rocks and in cavities. Birds on eggs were found at Motu Oa, near Ua Pou in March 2010, indicating that this period was likely the breeding season.

Polynesian Storm-petrel *Nesofregetta fuliginosa*. Probable breeder. One was seen flying along a cliff in September 2009 close to the summit of the main islet. One individual was seen in flight near the stack on 25 March 2010.

White-tailed Tropicbird *Phaethon lepturus*. Probable breeder. Two birds were seen in March 2010 in cliffs of the main islet, probably from two pairs nesting in cavities.

Red-tailed Tropicbird *Phaethon rubricauda*. Breeder. Three specimens were collected at nests in small caves and "a dozen or more" were seen in flight on 19 September 1922 (Beck unpublished journal). Five to six individuals were seen in flight over the main islet above the plateau and the northern cliffs in September 2009. During March 2010, 130 nests were found in the accessible parts of the main islet, with adults, eggs or juveniles present. More than 40 were seen in flight at any one time during our 2010 survey.

Masked Booby *Sula dactylatra*. Breeder. This species was not recorded in 1922. In September 2009, around 150 pairs were estimated on the plateau and the western slopes of the islet. In March 2010, 73 nesting pairs and 60 displaying pairs being formed were noted. Around two-thirds of the nests observed were at egg stage.

Red-footed Booby *Sula sula*. Nonbreeder. Only a few individuals were seen in flight around both islets in September 2009 and March 2010.

Brown Booby *Sula leucogaster*. Breeder. This species was recorded and collected on 19 September 1922 (Beck unpublished journal). Around 100 pairs were estimated breeding in September 2009 on the main plateau and western slopes above 60 m elevation on the main islet. In March 2010, 130 nesting pairs and two pairs being formed were noted, with about one-half of the observed nests being at chick stage. Twelve individuals were seen on the stack, but with no evidence of nesting.

Great Frigatebird *Fregata minor*. Nonbreeder. Only a few individuals, mostly juveniles, seen in flight over the main islet in March 2010.

Lesser Frigatebird *Fregata ariel*. Nonbreeder. Five to six individuals were seen in flight in September 2009 above the main islet, with at least two juveniles. Several dozen birds were seen in flight in March 2010, but no sign of nesting was observed.

Pacific Reef Heron *Egretta sacra*. Possible breeder. This species was not recorded by the WSSE. One individual was seen on the stack and two on the main islet in September 2009. In March 2010, at least two individuals were seen close to sea level on the main islet. No nests were seen, but occasional breeding is not excluded.

Pacific Golden Plover *Pluvialis fulva*. Nonbreeder migrant. This species was not recorded by the WSSE. Only one individual was seen at 190 m elevation on the main islet on 21 March 2010.

Bristle-thighed Curlew *Numenius tahitiensis*. Nonbreeder. Only one individual was seen on the plateau on the main islet in March 2010, eating an egg from a Brown Booby nest.

Wandering Tattler *Tringa incana*. Nonbreeder migrant. One specimen was recorded by the WSSE on 19 September 1922 (Stickney 1943). One individual was heard on the stack and several seen regularly at sea level on the main islet in March 2010.

Grey-backed Tern *Sterna lunata*. Breeder. Between 20 and 50 pairs were recorded in September 2009 on the main islet, in flight above the slopes of the plateau and on the ground on tussock areas. In March 2010, at least 9 nests were found on the main islet, between 70 m and 200 m elevation, and several tens of birds were seen in flight.

Sooty Tern *Sterna fuscata*. Breeder. A group flying above the stack was recorded on 19 September 1922 (Beck unpublished journal), and several specimens collected (AMNH). Around 800 breeding pairs were noted on the stack in September 2009. In March 2010, between 5 000 and 10 000 birds were estimated to be nesting on the stack. Numbers were estimated by counting quanta of birds in flight. This species was not recorded on the main islet, aside from a few individuals in flight.

Brown Noddy *Anous stolidus*. Breeder. This species was not recorded by the WSSE. Around 20 individuals were seen on the stack and around 50 individuals on the main islet in September 2009, both in flight or on the ground. In March 2010, more than

1000 birds were observed on the stack and several hundreds on the main islet, but only one nest with an egg was seen.

Black Noddy *Anous minutus*. Breeder. At least one chick was collected on a cliff nest on 19 September 1922 (Beck unpublished journal). This species was recorded at sea off Hatu-iti in September 2009. In March 2010, around 100 nests were seen on the southwestern cliffs of the main islet between 50 m and 120 m elevation.

Blue Noddy *Procelsterna cerulea*. Breeder. Recorded flying along a cliff on 19 September 1922 (Beck unpublished journal). Noted on the stack (around 100 breeds) with several nests and eggs in the cliffs and on the main islet (more than 500) in flight or roosting on the cliffs in September 2009. In March 2010, several hundreds were nesting on the main islet and tens nesting on the stack.

White Tern *Gygis alba*. Breeder. Several tens were recorded on the main islet, and at least two breeding birds in a shelter in a small cliff in September 2009. In March 2010, several tens of birds were seen on the main islet, and at least seven nests with eggs and chicks observed.

Marquesan Swiftlet *Collocalia ocista*. Nonbreeder. One individual was seen at 180 m elevation on the main islet on 21 March 2010, probably an erratic bird from nearby islands.

Other terrestrial fauna

Pacific Rat *Rattus exulans.* Present on the main islet, but not on the stack: 65 were trapped over 171 trap-nights. No other mammals were detected.

On the main islet, two lizards were found: the skink *Cryptoblepharus poecilopleurus* and the gecko *Gehyra mutilata.* The skink was also found on the stack. No previous inventory of reptiles for this site is known (Ineich and Blanc 1988). Among the insects noted were *Monomorium liliuokalanii*, an ant indigenous to the region, and *Periplaneta australasiae,* a cockroach. Two land-crab species were seen: *Geograpsus grayi* and *G. stormi.* At least three species of spiders were collected.

Vascular flora

Only four native vascular plant species have been recorded on the main islet: a tussock endemic to the Marquesas Islands, *Leptochloa xerophila,* is the main vegetation cover; the succulent *Portulaca lutea* (Portulacaceae) is common in patches; the fern *Microsorum grossum* (Polypodiaceae) occurs in patches; and *Nephrolepis hirsutula* (Nephrolepidaceae) is found in localised patches on humid cliffs. The first three species were all collected by W.B. Jones in the 1922, by Perlman in 1988 and by Florence in 1988. The fourth species was first noted and collected by J.F.B. in 2009. No introduced plant species were found at the site, which is exceptional in the French Polynesian region. The small stack had no vegetation cover, being covered in guano from roosting birds.

Human visitation

In prehistoric times, Hatu-iti was used for ceremonial or burial purposes (Linton, 1925). Indeed, several stone structures and cairns on the upper slopes of the main islet and also on the small islet were found in 2009 and 2010. As there is no running water on the islets, visits were probably always brief. Historically, the lower slopes of the main islet were used to dry fish. Some installations were evident in a low-altitude rock-shelter on the main islet. Currently, regular (e.g. weekly) visits by fishers occur, but it is thought that they seldom land (X. Curvat, pers. comm.).

DISCUSSION

Our visits at the site showed an unexpectedly rich avifauna, with 23 species, among which were 16 breeding species. The most numerous were shearwaters, which were seen commonly at night, although a few birds were found in burrows during the surveys. Although none was found in the group of burrows we inspected, both Audubon's and Wedge-tailed shearwaters were found in burrows searched opportunistically. A strong population (130 pairs) of nesting Red-tailed Tropicbirds *Phaeton rubricauda* were observed. Polynesian Storm-petrels *Nesofregetta fuliginosa* and Phoenix Petrels *Pterodroma alba* were seen: Polynesian Storm-petrels only on the stack, and Phoenix Petrels on the main islet in small numbers (one nest was found).

We found all the 14 species reported by the WSSE. The greater species diversity noted in our visits is likely in large part to be due to the longer duration of our visit compared with any previous surveys of the site. With 16 breeding and seven nonbreeding species, the site is an important one for marine bird species in the region. Similar numbers of species are present at the nearby Important Bird Area of Hatuta'a, which also has Polynesian Rats (Butaud and Jacq 2007, Thibault 1989), although it is a much smaller site. The timing of our visit probably coincided with the breeding period for many of the species at the site, although variation in tropical seabird breeding sites does not allow for accurate estimation of their phenology (del Hoyo *et al*. 1992).

Hatu-iti appears to be a particularly important site for the conservation of marine bird species in the region. Two listed as endangered by the IUCN, Phoenix Petrel and Polynesian Storm-petrel, were present. These species and Bulwer's Petrel are represented at only a few sites in Polynesia, and in low numbers at the majority of these sites (Thibault and Bretagnolle 2007).

The measurements of the Phoenix Petrel from Hatu-iti were consistently 2–3 mm larger than the average values for those recorded by Murphy and Ponnoyer (1952), but within the range described for the species. Differences of this magnitude may be due to observer error or to the difference in measurements of museum skins versus live animals.

Uncertainty remains as to whether Hatu-iti is a breeding site for the Polynesian Storm-petrel. However, we conjecture that, if it occurs, it is restricted to the stack off Hatu-iti or to inaccessible areas of cliff on Hatu-iti or to both. Pacific Rats are a known predator of small ground-nesting seabirds and are likely to kill any storm-petrels present on the islet. BirdLife International (2010) noted that the global population of Polynesian Storm-petrel may be as low as 1000–1600 mature individuals, but also that estimates were dated and highly uncertain. They considered that the populations may have suffered local extinctions since the 1990s, when many surveys were undertaken. Clearly, there is an urgent need to create secure habitat free of introduced mammalian predators for the Polynesian Storm-petrel. Therefore, the eradication of Pacific Rat from Hatu-iti would provide extensive high-quality breeding habitat for this threatened species.

The impact of the Pacific Rat was considered when examining the species present on the stack compared with the main islet. For example, Sooty Terns were numerous at the stack, and small petrels such as Bulwer's Petrel and Polynesian Storm-petrel were seen near the stack but not on the main islet. Consequently, the presence of rats at the main islet may be limiting the distribution of these small seabirds. The proximity of source populations of these species means that breeding colonies on the main islet are likely to establish rapidly should rats be removed.

When considering the potential for restoring the native fauna and flora assemblage of Hatu-iti, the importance of preventing the introduction of rats and other alien species needs to be considered. The site is far enough from adjacent land masses to exclude re-colonisation by swimming. At the present time, local people spend relatively little time at Hatu-iti. This is partly because access to the site is difficult, with no easy landing area. The site does not benefit from formal protected-area status currently, and is "protected" only by its fierce topography and relative remoteness. Clearly, given the importance of the site for seabird conservation at a regional level, it would be beneficial to have formal protected area status for Hatu-iti and its associated stack.

We conclude that the site has high biodiversity value, both in terms of the numbers of species and of globally threatened populations present, albeit in small numbers. High priority should be given to restoring the site by removing rats, and to giving the area formal protected-area status.

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